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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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09/212,726 12/15/98 SCHUEGRAF

K M122-1098

021567 MMC2/0228
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EXAMINER

KIELIN, E

ART UNIT

PAPER NUMBER

2813

DATE MAILED:

12
02/28/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.
09/212,726

Applicant(s)
Schuegraf

Examiner
Erik Kielin

Group Art Unit
2813

☒ Responsive to communication(s) filed on Jan 30, 2001

☐ This action is **FINAL**.

☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire 3 month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claims

☒ Claim(s) 39-42 and 44-52 is/are pending in the application.

Of the above, claim(s) _____ is/are withdrawn from consideration.

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) 39-42 and 44-52 is/are rejected.

☐ Claim(s) _____ is/are objected to.

☐ Claims _____ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been
☐ received.

☐ received in Application No. (Series Code/Serial Number) _____.

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

☒ Notice of References Cited, PTO-892

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). _____

☐ Interview Summary, PTO-413

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

--- SEE OFFICE ACTION ON THE FOLLOWING PAGES ---

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DETAILED ACTION

Claim Rejections - 35 USC § 112

Amendment to the claims to remove the requirement for the unsubstantiated reduction in the decomposition rate of the organosilicon presursor

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims **48** and **52** are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Claim 48 requires "conditions which are effective to... reduce the theoretical decomposition rate [of the organic silicon precursor] to a lower actual decomposition rate." In short, addition of H₂O or H₂O₂ speed up rather than decrease the decomposition rate of the organic silicon precursor -- not reduce it.

Examiner respectfully submits that the only provision for reducing the decomposition rate provided in the specification is an *incorrect* application of Le Chatelier's Principle which can be found beginning on page 9, line 20. The information regarding the theory is incorrect for at least the following reasons: (1) The organic silicon precursor is *not in equilibrium* with the at least one

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of H_2O or H_2O_2 because both intermediate and product compounds of silicon are being removed from the system by deposition onto the substrate which, according to the aforementioned theory, *speeds up rather than reduces* the decomposition of the precursor. (See, for example, Applicant's admitted prior art article by IslamRaja et al., page 722, last paragraph, right-hand column.) (2) There is *no reverse reaction*, so an equilibrium cannot exist. Instead, each of the organic silicon precursors claimed by Applicant can only produce H_2O by reaction of the organic portion only, the reverse reaction is thermodynamically prohibited under the conditions presented by Applicant. (3) Assuming *arguendo* that H_2O or H_2O_2 were somehow in equilibrium with the organic silicon precursor, as both a reactant and a product, H_2O or H_2O_2 would tend to cancel each other out in effect of shifting equilibrium. As more H_2O (or H_2O_2) would be produced, more reactant and product would be introduced which would tend to cancel in effect to a degree determined by the stoichiometry of the reaction. Without a specific precursor, it is impossible to determine such stoichiometry and therefore impossible to determine the alleged degree of reduction -- again assuming *arguendo* such equilibrium exists.

Examiner acknowledges the well known fact that H_2O (or H_2O_2) is a product of the *net* or *global* reaction in the decomposition of the organic silicon precursors (IslamRaja et al. page 722, equation (1) and paragraph thereafter) but H_2O (or H_2O_2) is *not* in equilibrium with the precursor and therefore cannot reduce the rate as alleged by Applicant in the specification. Consequently one of ordinary skill would find either *no change* in the decomposition rate or more likely an *increase* in decomposition rate of the organic silicon precursor as found, for example, by

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Sukharev (US 5,710,079; column 3, line 66 to column 4, line 13) for tetraethylorthosilicate (TEOS). Absent evidence to the contrary, the method as claimed would not operate as alleged.

Since Applicant indicates that they have observed a decrease in the rate (Remarks section of Paper No. 7, page 4, lines 9-10), **Applicant could overcome the rejection simply by providing a signed affidavit with the appropriate experimental data showing such decrease in rate in fact occurs.** This should not provide a burden since Applicant indicates that such data already exists. This evidence is necessary since the preponderance of evidence indicates that (1) Applicant's theory regarding the decomposition rate is flawed and (2) addition of water and hydrogen peroxide increase rather than decrease the decomposition rate of TEOS. See section entitled, "*Response to Arguments*" for further reasoning.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371© of this title before the invention thereof by the applicant for patent.

4. Claims **39-40, 42, 44 and 47, 49** are rejected under 35 U.S.C. 102(e) as being anticipated by **Sukharev** (US 5,710,079).

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Sukharev discloses a method of depositing SiO_2 on a substrate using a $\text{H}_2\text{O}/\text{H}_2\text{O}_2$ CVD process in which an organic silicon precursor (for example, TEOS, and others as in claim 7) and H_2O and/or H_2O_2 are fed separately into a CVD reactor (column 5, lines 55-65) in a concentration of 0.5 to 6 percent (column 7, last paragraph). The H_2O may be introduced without H_2O_2 (col. 6, ln. 55). (See also columns 3-7; Figs 2-3.)

Because the concentration range claimed by Applicant in claims 40-42 to provide conditions “which are effective to reduce formation of undesired reaction intermediates” (see specification page 12, lines 3-13) overlap those in **Sukharev**, the method of **Sukharev** must inherently reduce the formation of undesired reaction intermediates. See In re Swinhart, 169 USPQ 226,229 (CCPA 1971) (where the Patent Office has reason to believe that a functional limitation asserted to be critical for establishing novelty in the claimed subject matter may, in fact, be an inherent characteristic of the prior art, it possesses the authority to require the applicant to prove that subject matter shown to be in the prior art does not possess the characteristics relied on) and In re Fitzgerald, 205 USPQ 594 (CCPA 1980) (the burden of proof can be shifted to the applicant to show that subject matter of the prior art does not possess the characteristic relied on whether the rejection is based on inherency under 35 USC 102 or obviousness under 35 USC 103).

Although **Sukharev** does not specifically indicate that the presence of H_2O and/or H_2O_2 decreases undesired reaction intermediates, **Sukharev** does indicate that the growing SiO_2 film has reduced carbon resulting which is an intermediate in the decomposition of the organic

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moieties of TEOS. It is held, absent evidence to the contrary, that the method of **Sukharev** will inherently reduce the presence of unwanted reaction intermediates.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 39-42, 44 and 47, 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Sukharev**.

The prior art as explained above discloses all of the limitations of the instant invention, but does not teach Applicant's concentration range of 5-15%. Instead, **Sukharev** discloses ranges of 0.5 to 3% H₂O and 0-3% H₂O₂.

However, it has been held that choosing parameters within or near ranges taught by the prior art is *prima facie* obvious. See *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976). See also *In re Huang*, 40 USPQ2d 1685, 1688(Fed. Cir. 1996)(claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art).

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Therefore, it would have been obvious to choose a concentration with Applicant's range because Sukharev discloses the overlapping range of a combination of H_2O and H_2O_2 of 0.5-6%, according to the precedent set by *In re Wertheim* or *In re Huang*.

Further in this regard, since Applicant clearly teaches that any amount of water less than 50% or less than 5% is sufficient to attain Applicant's observed reduction in undesired reaction intermediates, it is unclear how 5% to 15% could produce unexpected results. Nonetheless, no evidence has been provided by Applicant.

7. Claims 45-46, 50-51 **48**, 52 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Sukharev** in view of **Wolf** (Silicon Processing for the VLSI Era, Vol. 1).

The prior art as explained above in paragraph 8 discloses all of the limitations of claims of the claimed invention except for specifically indicating that the CVD reactor is a hot wall (claim 45) or a "cold hot" reactor (claim 46) or using a hot-wall, low-pressure CVD reactor (claim 48) to deposit the silicon oxide film.

However, **Wolf** teaches that hot-wall, low-pressure CVD reactors are the most widely used reactors and are employed for depositing silicon oxide films because of their superior economy, throughput, uniformity, and ability to accommodate large diameter wafers on page 169, last 8 lines). **Wolf** also teaches the benefits of using cold wall reactors on page 171, first paragraph.

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Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to apply the teachings of **Wolf** to the **Sukharev** reference for the reasons given by **Wolf**.

Response to Arguments

8. Applicant's arguments filed 1/30/01 have been fully considered but they are not persuasive.

Applicant argues that **Sukharev** uses UV radiation, but Applicant's claims are not so limited.

Applicant argues further in regard to **Sukharev** that Examiner has failed to provide "a reasonable argument regarding inherency." Examiner respectfully disagrees and directs Applicant to the arguments provided in the previous office action (Paper No.8, filed 10/30/00) under the section the entitled "***Response to Arguments***" (emphasis original) which were conveniently ignored by Applicant in the present response. The entirety of such arguments are incorporated herein. In short salient summary, Applicant argues that because Sukharev uses UV radiation plus ozone plus water or, alternatively, hydrogen peroxide plus water plus UV radiation, that Applicant's method is somehow different. But as previously indicated by Examiner, Applicant's method uses a thermal process or, alternatively, H₂O plus O₂ in a *plasma* CVD method **both of which necessarily produce hydroxyl radicals**, as indicated by the supporting references provided earlier. Therefore, Applicant's reaction mixture shares the same rate accelerating hydroxyl radicals, as in that of Sukharev, no matter the method by which the hydroxyl radicals are

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produced. Therefore, if Applicant is seeing a decrease in the production of undesired reactive intermediates due to an alleged decrease decomposition rate of TEOS, the so must **Sukharev** because the reaction mixtures contain the same reactive intermediates.

Applicant continues to argue that Examiner's assessment of the theory is incorrect. Examiner expressly disagrees for the reasons indicated above and for reasons indicated during the course of the telephone interview. Applicant has still failed to provide evidence that the decomposition rate of the organic silicon precursor would show a decreased rate of decomposition under the conditions provided in the specification. Again, the overwhelming majority (all, as a matter of fact,) of the evidence presently of record indicates that the oxides of hydrogen (H_2O and H_2O_2) increase rather than decrease the decomposition rate of organic silicon precursors.

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Homma (US 5,334,552; column 6, lines 21-68) and **Kubo et al.** (US 5,840,631) each **anticipate at least the independent claims of the instant invention.**

10. Any inquiry concerning this communication from examiner should be directed to Erik Kielin whose telephone number is (703) 306-5980 and e-mail address is erik.kielin@uspto.gov.

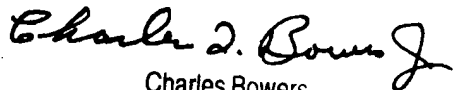
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The examiner can normally be reached by telephone on Monday through Thursday 9:00 AM until 7:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Charles Bowers, can be reached at (703) 308-2417 or by e-mail at charles.bowers@uspto.gov. The fax phone number for the group is (703) 308-7722 or -7724.

EK

February 24, 2001


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